

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference 9591WO/AT/LA	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/IB2004/003390	International filing date (day/month/year) 18-10-2004	Priority date (day/month/year) 16-10-2003
International Patent Classification (IPC) or national classification and IPC See Supplemental Box		
Applicant ABB Research Ltd et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:

☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input checked="" type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand 04-05-2005	Date of completion of this report 10-01-2006
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 Form PCT/IPEA/409 (cover sheet) (April 2005)	Authorized officer Nils Engnell/Els Telephone No. +46 8 782 25 00

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Cover sheet

INTERNATIONAL PATENT CLASSIFICATION (IPC):

H01R 13/03 (2006.01)

C23C 30/00 (2006.01)

H01R 39/20 (2006.01)

H01R 41/00 (2006.01)

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Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____,
which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished
- ☒ the description:
pages 2 - 33 as originally filed/furnished
pages* 1 received by this Authority on 16-08-2005
pages* _____ received by this Authority on _____
- ☒ the claims:
pages 25 - 31, 33 as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 24 received by this Authority on 16-08-2005
pages* 32 received by this Authority on 09-11-2005
- ☒ the drawings:
pages 1 - 6 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. II **Priority**

1. ☒ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:
- ☒ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).
- ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).
2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1). Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-56</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-56</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-56</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Reference is made to the following document:

D1 WO 03/046247 A1

Discussion.

The present invention basically refers to electrical contact elements comprising a film of a composite material comprising a so called "MAX-material" as an essential constituent. The material comprises compounds and/or phases based on the same atomic elements as the actual corresponding "MAX-material".

D1 represents the closest prior art. It relates to a method of synthesizing "MAX-material" from vapours. It is stated that the composition of a formed layer or film can be varied not only to form different pure "MAX-phases", but also to include for example carbides, nitrides and metals (p. 5, l. 22 - p. 6, l. 19). Therefore, "MAX-materials" per se according to the present invention as defined in the claims are known from D1. In addition, D1 states that "MAX-materials" can be used in contact surfaces in electrical contact elements (p. 7, ll. 11-21).

The present invention differs from what is disclosed in D1 in that it is explicitly stated that composite "MAX-materials" are used in contact elements. Consequently, the present invention is novel. It is considered not obvious to a person skilled in the art to arrive at the invention in its embodiments defined in present claims 1-52. The invention is industrially applicable.

9591 WO

2004-10-16/AT

Coatings

5

TECHNICAL FIELD

An element for making an electric contact to a contact member for enabling an electric current to flow between said element and said contact member. The element comprising a body having at least a contact surface thereof coated with a contact layer to be applied against said contact member. The contact layer comprises a continuous or discontinuous film comprising a multielement material.

15 BACKGROUND ART

Recent studies has shown that compounds having the general formula $M_{nH}AX_n$ exhibit unusual and exceptional mechanical properties as well as advantageous electrical thermal and chemical properties. Despite having high stiffness these compounds are readily machinable, resistant to thermal shock, unusually damage tolerant, have low density and are thermodynamically stable at high temperatures (up to 2300°C in vacuum). M is a transition metal or a combination of transition metals, n is 1, 2, 3 or higher, A is a group A element or a combination of a group A element, and X is Carbon, Nitrogen or both.

Group A element is any of a list: Aluminium Al, Silicon Si, Phosphorus P, Sulfur S, Gallium Ga, Germanium Ge, Arsenic As, Cadmium Cd, Indium I, Tin Sn, Thallium Tl, Lead Pb. Transition metal M is any of a list: Scandium Sc, Titanium Ti, Vanadium V, Chromium Cr, Zirconium Zr, Niobium Nb, Molybdenum Mo, Hafnium Hf, Tantalum Ta.

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CLAIMS

1. A contact element for making an electric contact to a contact member (5, 15, 19, 41) for enabling an electric current to flow between said contact element and said contact member, said contact element (3, 14, 20, 32, 42) comprising a body (6) having at least a contact surface (2, 4, 16, 21, 22, 24, 30, 34, 43, 44) thereof coated with a contact layer arranged to be applied against said contact member, which contact layer comprises a film comprising a multielement material, **characterised in** that said multielement material comprises material with equal composition as at least one of a carbide or nitride that is described as $M_{n+1}AX_n$ where M is a transition metal or a combination of a transition metals, n is 1, 2, 3 or higher, A is a group A element or a combination of a group A element, and X is Carbon, Nitrogen or both, said multielement material also comprise at least one nanocomposite comprising single elements, binary phases, ternary phases, quaternary phases or higher order phases based on the atomic elements in the corresponding $M_{n+1}AX_n$ compound.

2. A contact element according to claim 1, **characterised in** that said nanocomposite comprise at least two of the following phases: M-A, A-X, M-A-X, X, M-X, or a combination of said materials.

3. A contact element according to any of claim 1 or 2, **characterised in** that said nanocomposite comprise at least one of the following of M-X and M-A-X nanocrystals (C, D, E) and at least one of the following amorphous regions (J, K, L) with M, A, X elements in one or several phases, such as M-A, A-X, M-A-X, or X.

4. A contact element according to any of the preceding claims, **characterised in** that said transition metal is Titanium; Ti, n is 1, 2, 3 or higher, X is C; Carbon and A is at least one of Silicon; Si, Germanium; Ge or Tin; Sn or a combination of said atomic elements.

50. A contact arrangement according to claim 48, **characterised in** that said moving part is a slip ring (19).

51. A contact arrangement according to any of claims 38-42,
5 **characterised in** that it is adapted to establish an electric contact in a tap changer(28) for a transformer for making a contact to different winding(29) turns of the transformer.

52. A contact arrangement according to any of claims 38-42,
10 **characterised in** that one of the contact element (32) and the contact member (33) belong to the parts movable with respect to each other in a relay for establishing an electric contact there between when the relay operates.

53. A method for creating a thin layer on a contact element according to any
15 of the claims 16-22 for making a good electric contact of said contact element to a contact member for connection to said contact member and having a low friction coefficient with respect to said contact member and contact element pressed together for forming said good electric contact, **characterised**
20 **in** that the multielement material is coated with the metallic layer.

54. A method for creating a thin layer on a contact element according to any
of the claims 16-22 for making a good electric contact of said contact element to a contact member for connection to said contact member and having a low
friction coefficient with respect to said contact member and contact element
25 pressed together for forming said good electric contact, **characterised**
in that the multielement material is blended in the metallic layer.

55. Use of a contact arrangement according to any of claims 38-42, in which a
contact for enabling contact to an electronic device, such as an integrated cir-
cuit (IC) is covered with a said multielement material film enabling electrical
30 contact to the device.

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